

RUN12 100 GeV Optics Measurement and Analysis

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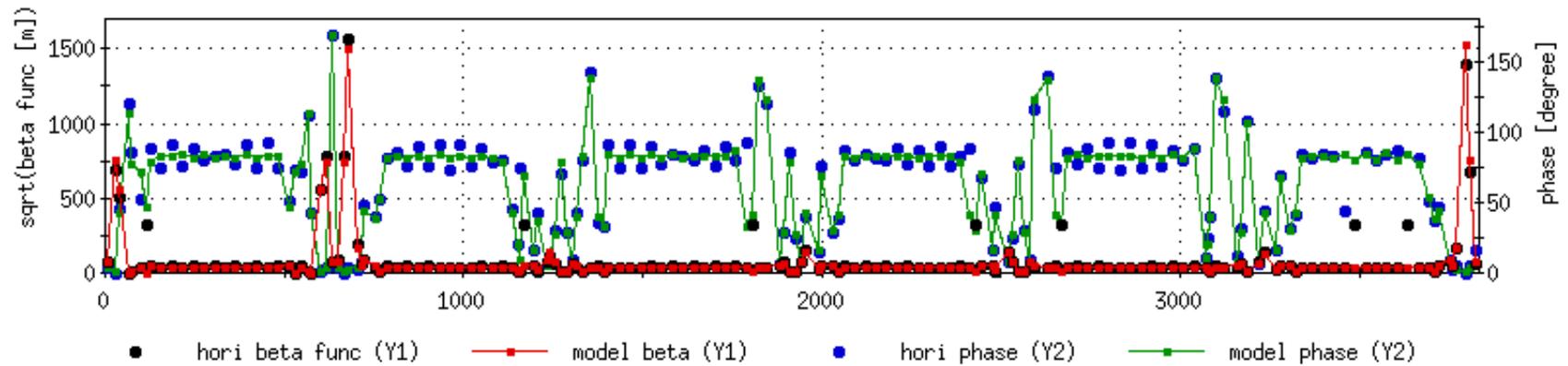
Measurement at 100 GeV

OpticsCorrection

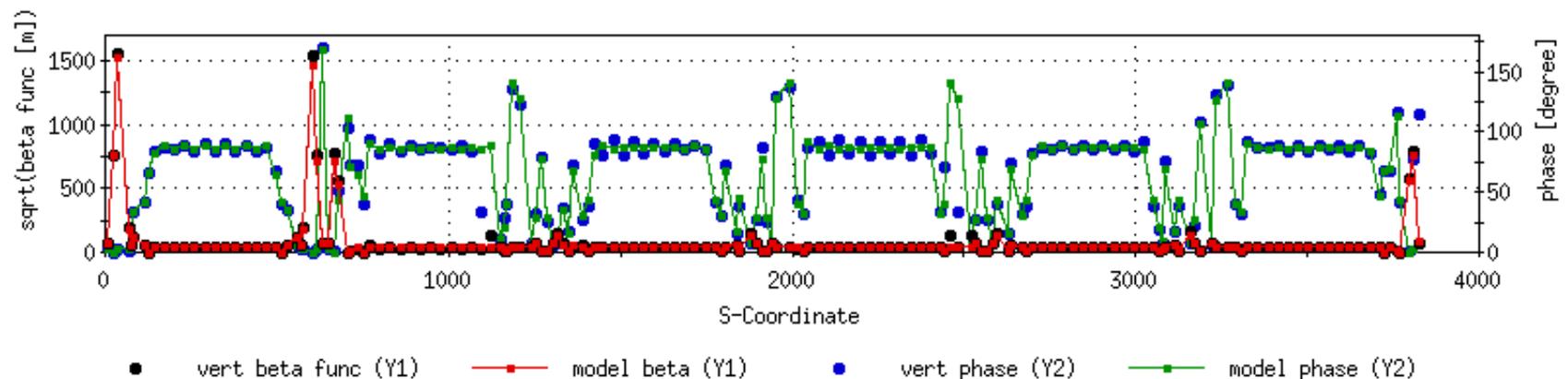
- Feb. 13, Fill # 16413
- Measured blue and yellow optics simultaneously by placing their tunes on top of each other. Both beams were longitudinally separated
- All measurements were done within 20 mins

Measured Beta and Phase advance: Blue

OpticsCorrection

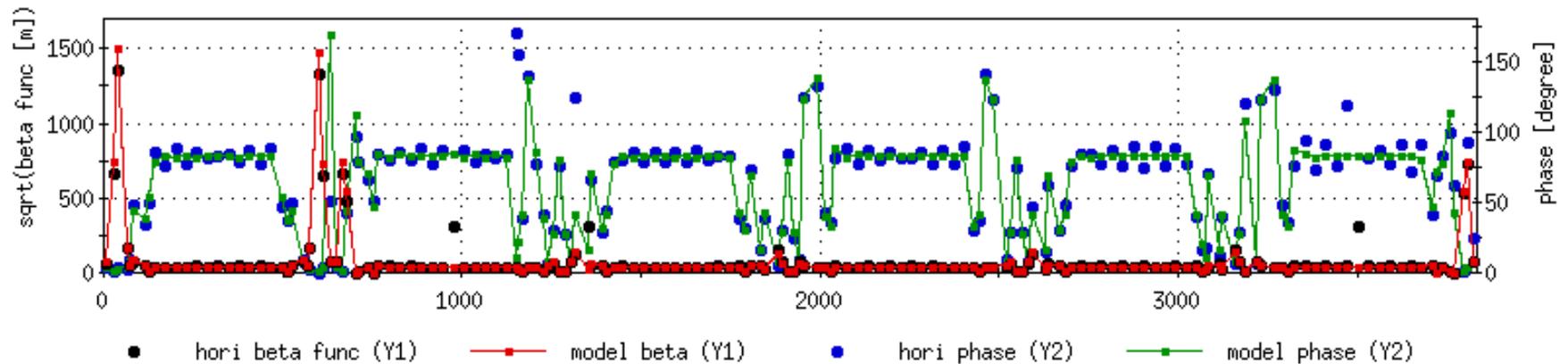


Lattice: Blue

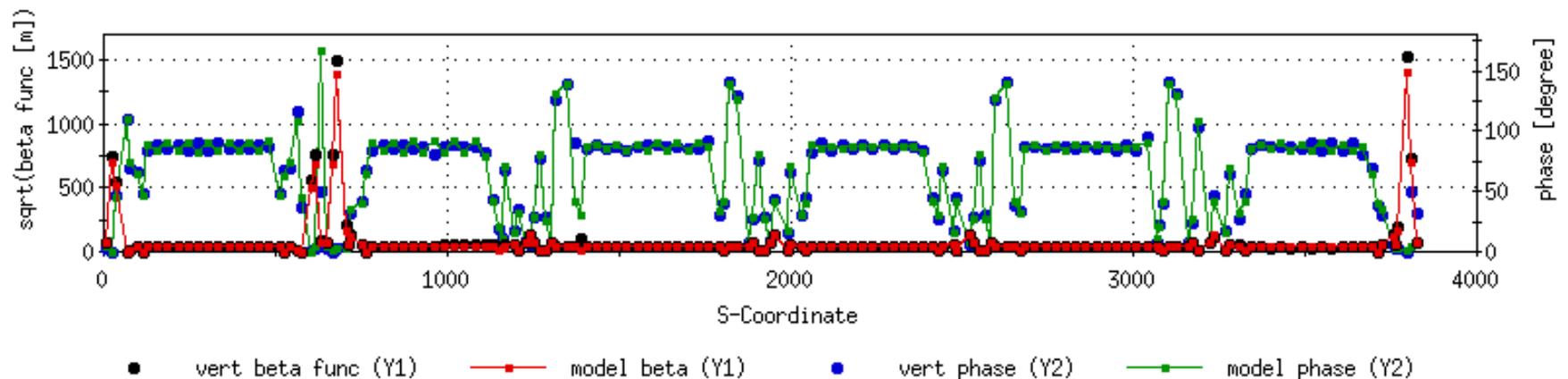


Measured Beta and Phase advance: Yellow

OpticsCorrection



Lattice: Yellow



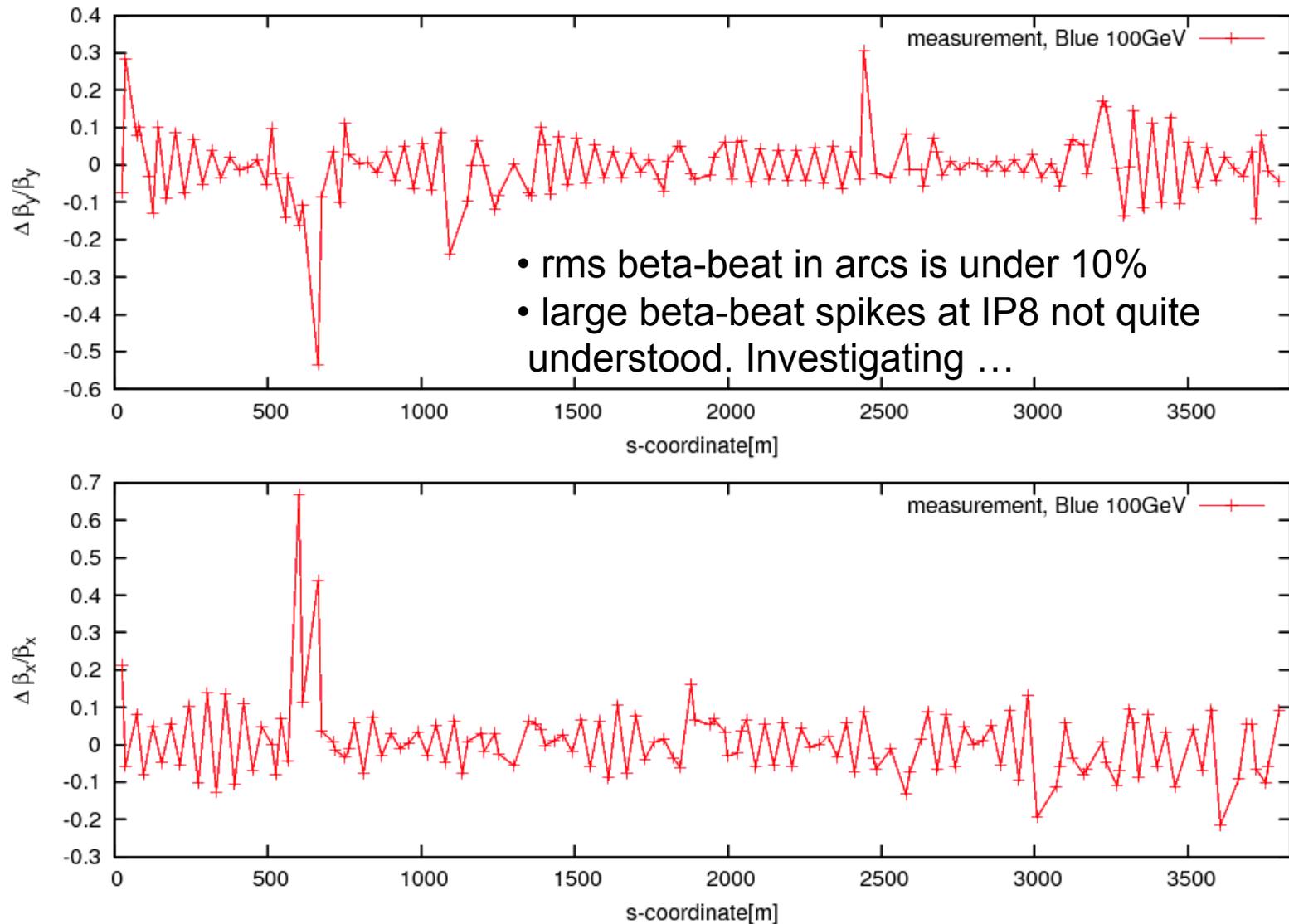
Beta* Measured RUN 12, 100 GeV, [m]

OpticsCorrection

Ring	Plane	IP2	IP4	IP6	IP8	IP10	IP12
Blue	H	10.59	10.74	0.92	0.80	12.08	8.91
	V	8.82	8.70	0.80	0.81	9.64	9.17
Yellow	H	10.94	9.08	0.90	0.95	10.30	9.46
	V	10.19	9.94	0.84	0.81	9.79	9.99

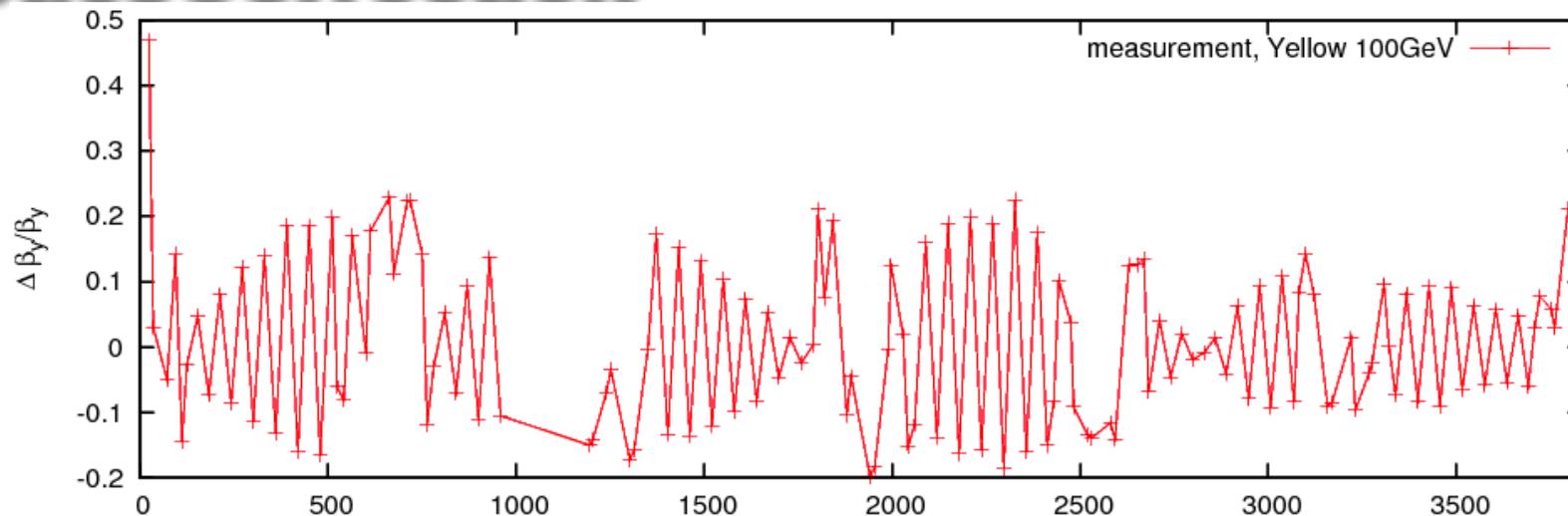
Measured Beta-Beat: Blue

OpticsCorrection

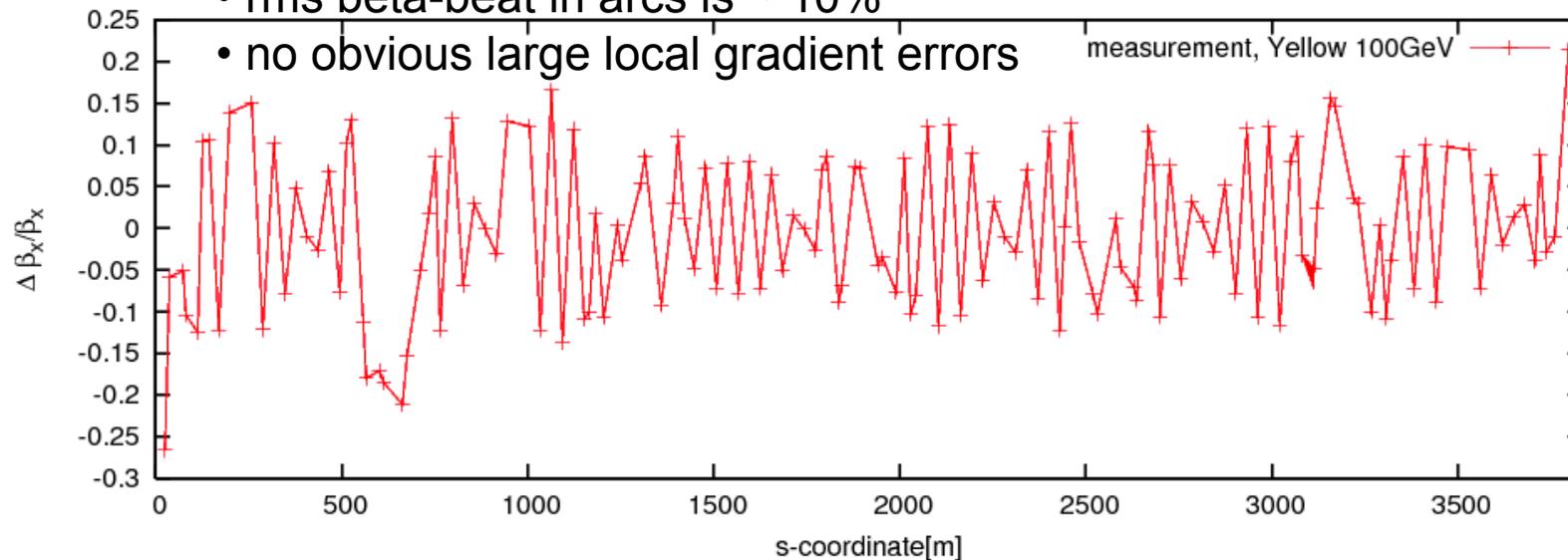


Measured Beta-Beat: Blue

OpticsCorrection

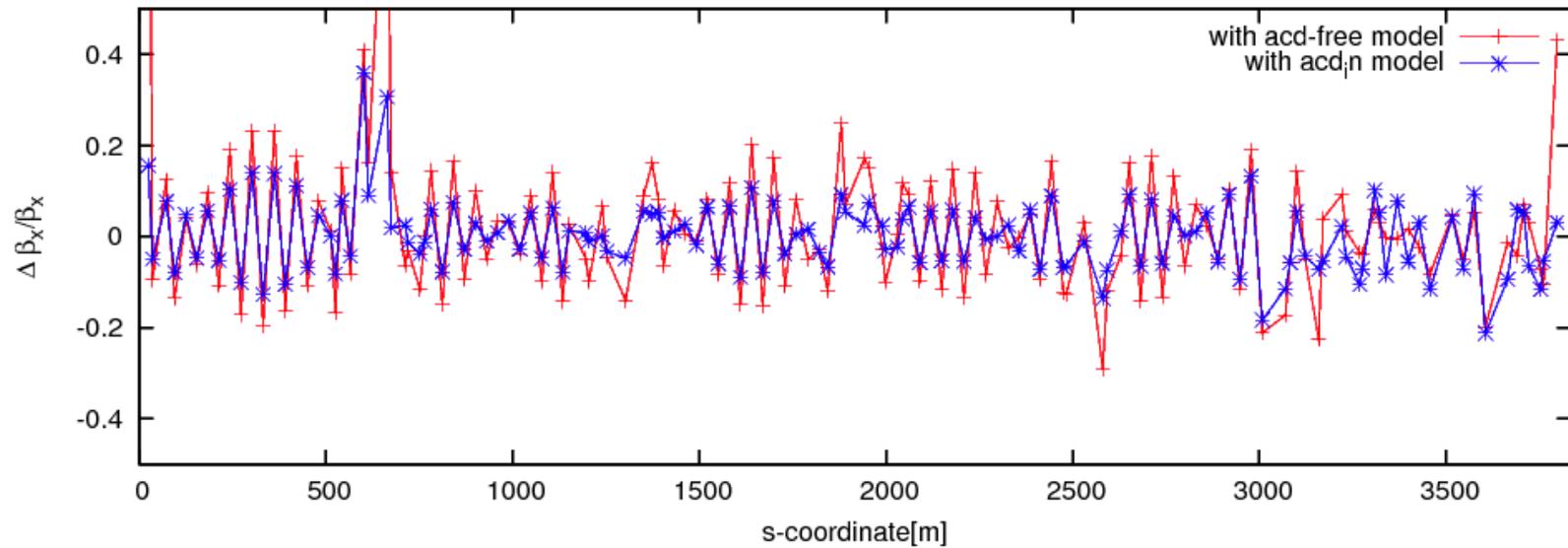
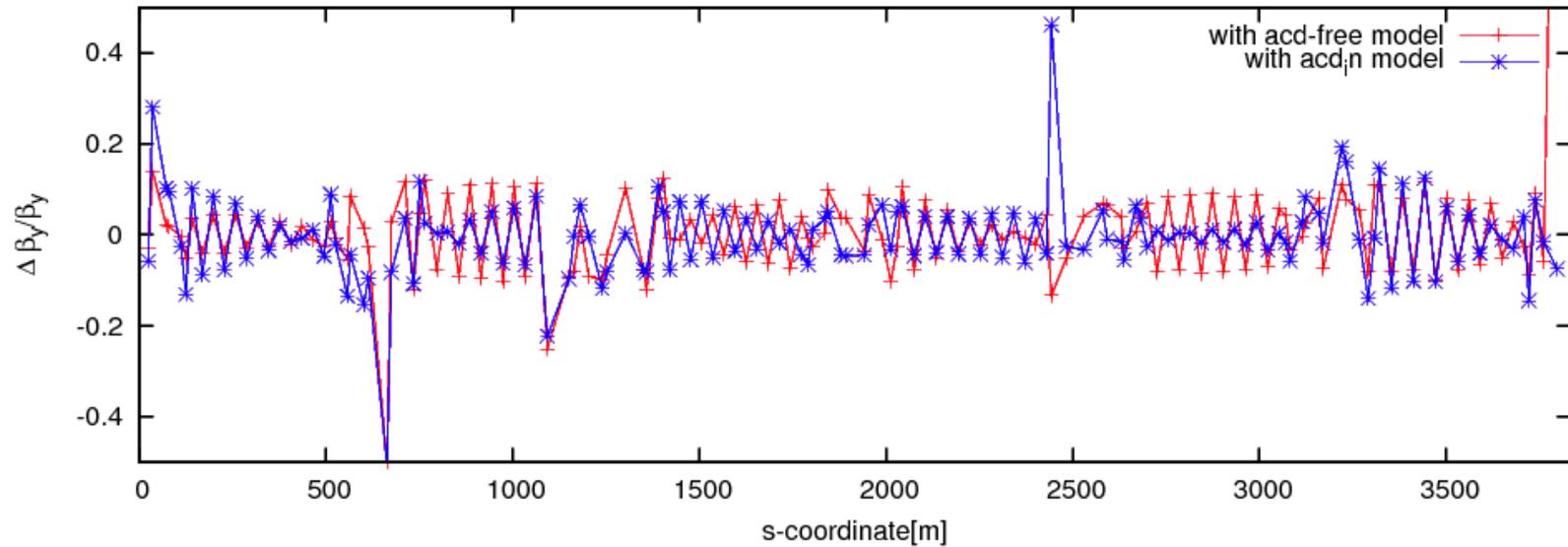


- rms beta-beat in arcs is $\sim 10\%$
- no obvious large local gradient errors



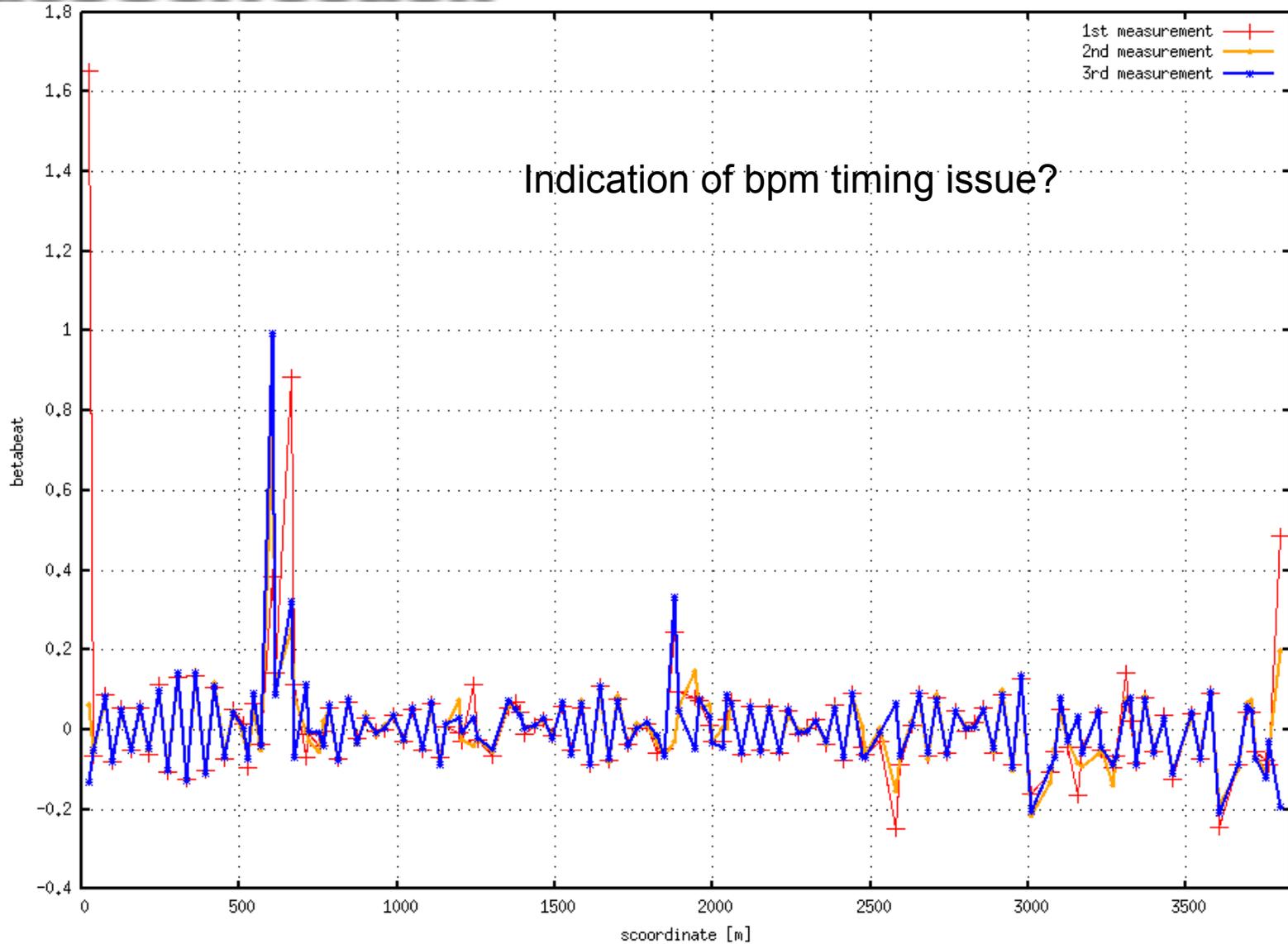
Effect of AC dipole on Beta-Beat

OpticsCorrection



Poor IR Data

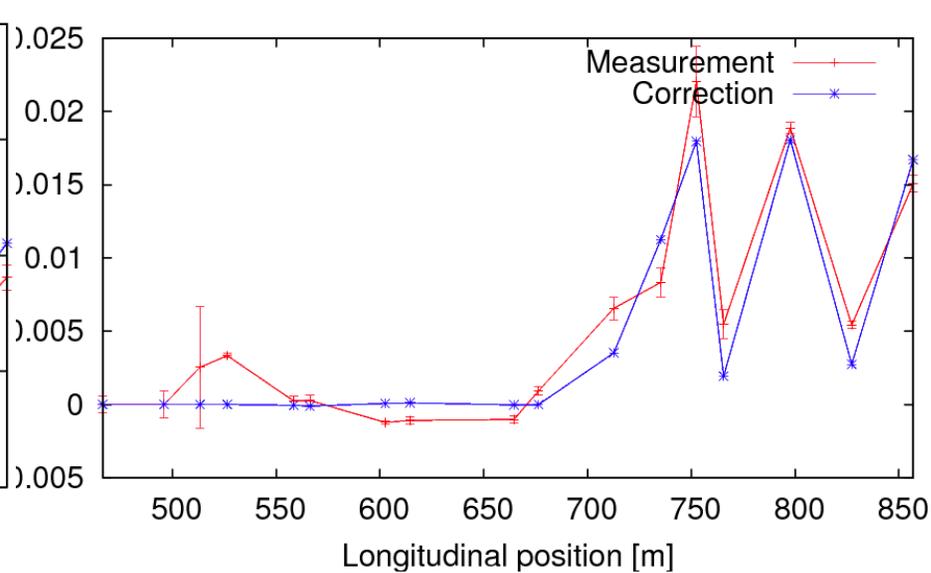
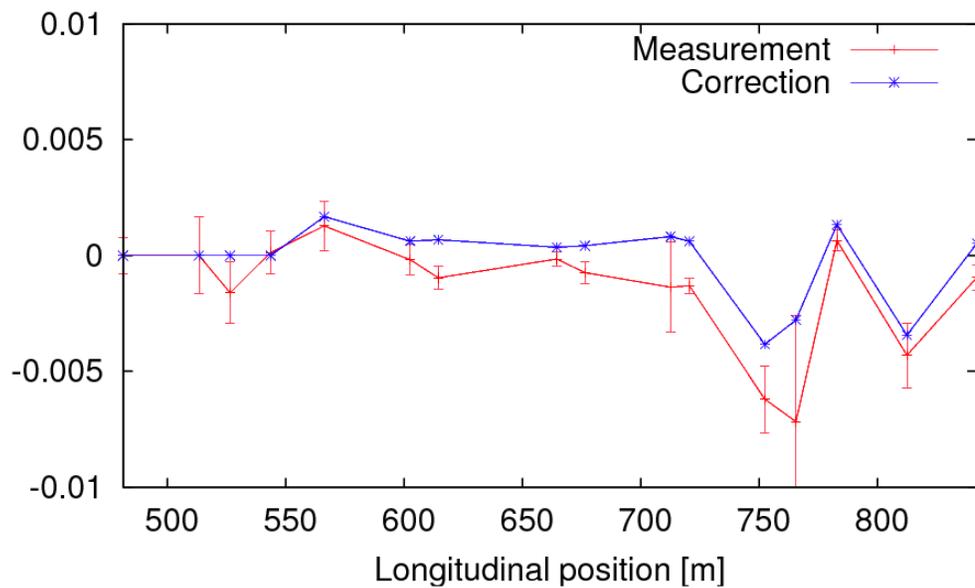
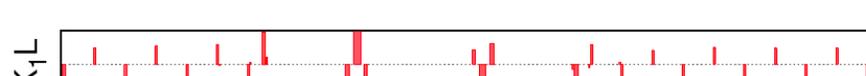
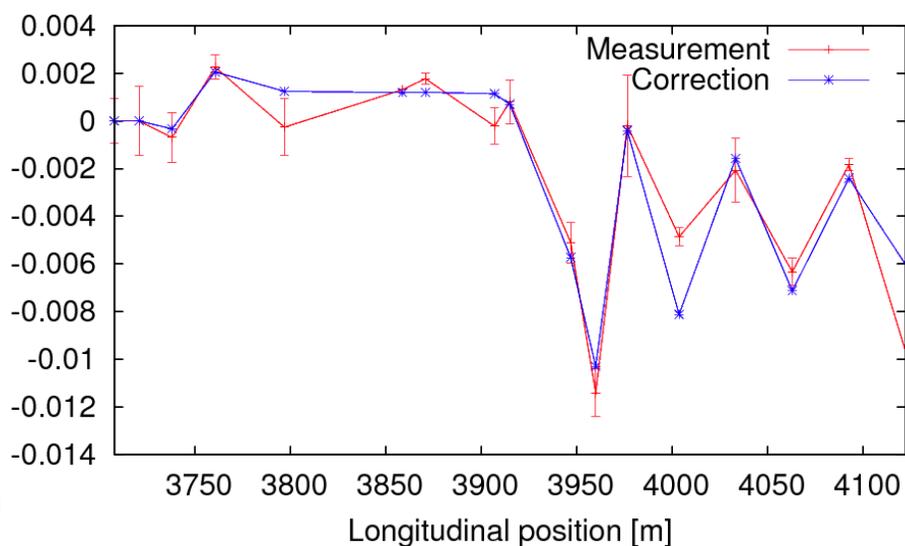
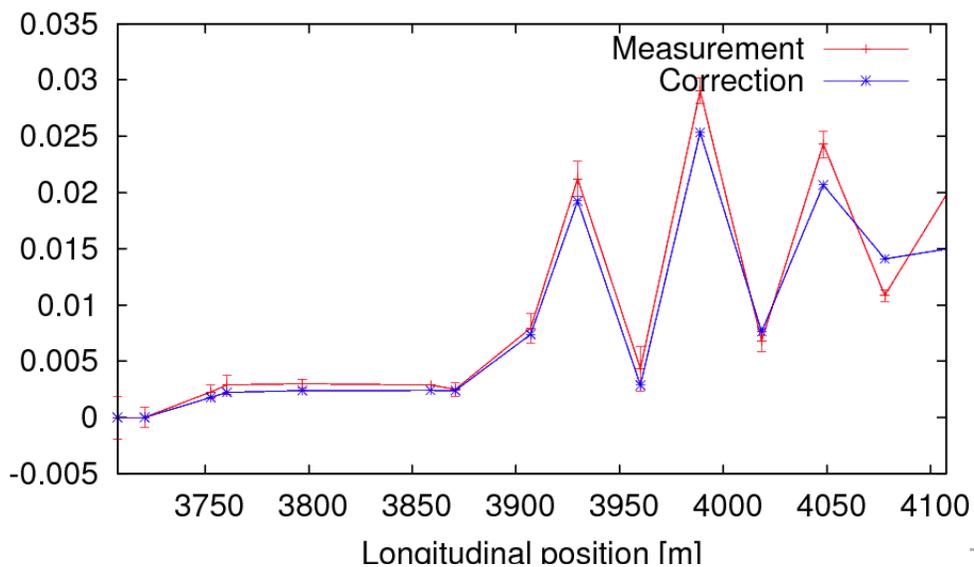
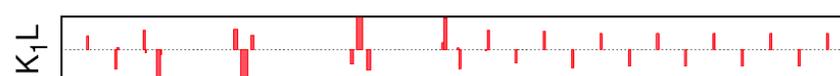
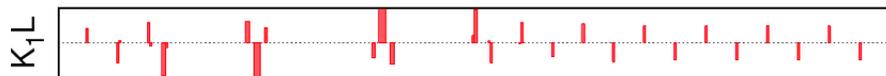
OpticsCorrection



SBST Analysis Results

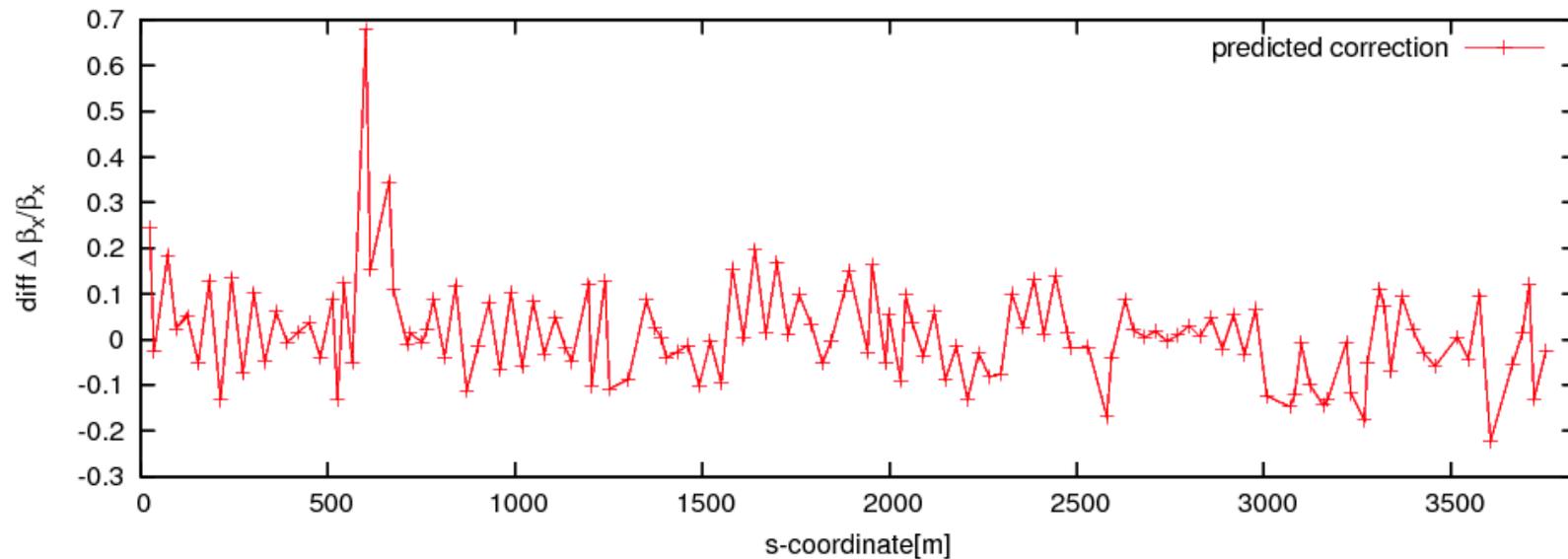
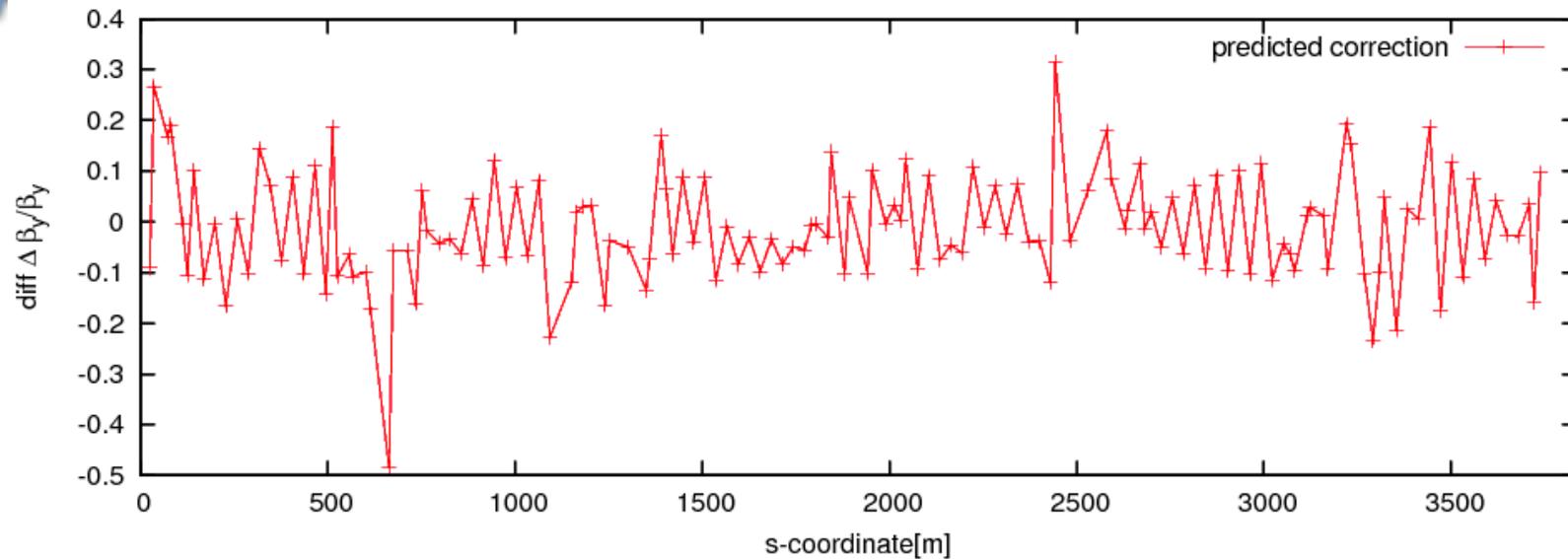
OpticsCorrection

IP2	IP4	IP6	IP8	IP10	IP12
Q2I2->K1 *0.9995;	Q2O4->K1 *0.995;	QFA6->K1 *1.002;	Q6O8->K1 *1.002	Q2I10->K1 *0.9985;	Q6OT12->K1 *1.01;
Q3I2->K1 *0.9995;	Q2I4->K1 *1.002;	Q7I6->K1 *1.005;	Q4O8->K1 *0.992;	Q1O10->K1 *0.997;	Q5OT12->K1 *0.993;
Q2O2->K1 *0.9995;	Q3I4->K1 *1.005	Q6IT6->K1 *0.99;	Q3O8->K1 *1.0003;	Q3O10->K1 *1.002;	Q4OT12->K1 *0.993;
Q3O2->K1 *1.001;		Q5IT6->K1 *0.97;	Q3I8->K1 *0.9997;		Q2O12->K1 *0.9999;
		Q4IT6->K1 *0.98;	Q5I8->K1 *1.008;		Q2I12->K1 *1.0002;
		Q3I6->K1 *1.0005;			Q4IT12->K1 *1.01;
		Q2I6->K1 *0.9999;			Q6IT12->K1 *1.02;
		Q7O6->K1 *1.008			Q7I12->K1 *1.005;
					QDA12->K1 *1.002;



Beta beat of SBST corrections, model

OpticsCorrection

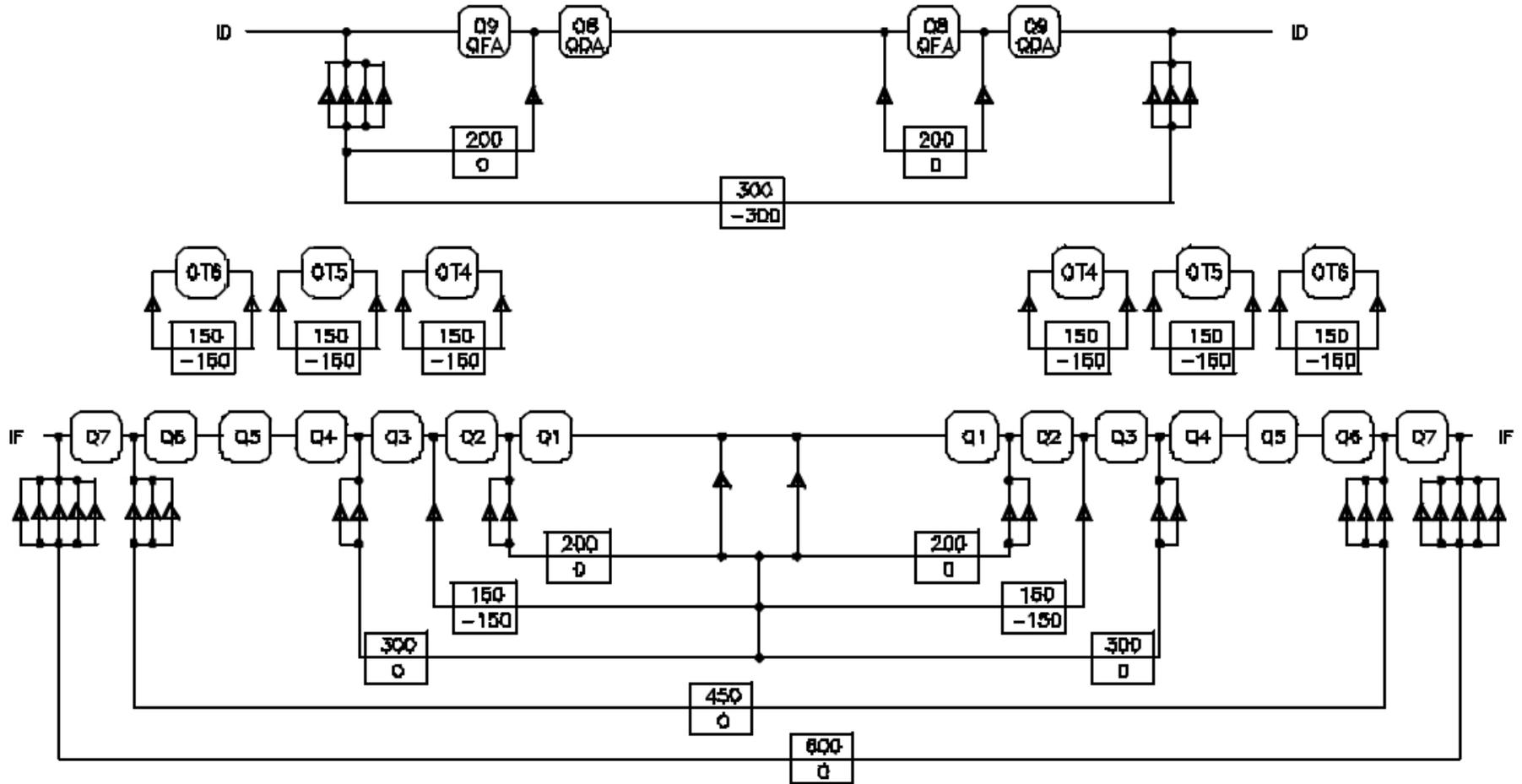


Optics Analysis Conclusion and Plan

OpticsCorrection

- Conclusions
 - Current SBST analysis seems to indicate there is no gross local gradient errors in Blue IR.
 - The SBST method is sensitive to measured phase advance at each bpm.
- Plan
 - Implement global correction
 - Investigating both approaches: SBST based as well as loptics results
 - Implement independent knobs, current instead of k value in the model: GRD
 - Currently, all the optics analysis are done by tweaking quad k value in the model. Quads in RHIC model is currently setup to reflect the nesting power supply configuration, except IR10&4. At the moment IR10&4 have the same configuration as the rest IRs in the model, but the power supply nesting schemes are not.
 - Guillaume is working on making the corrections on the model

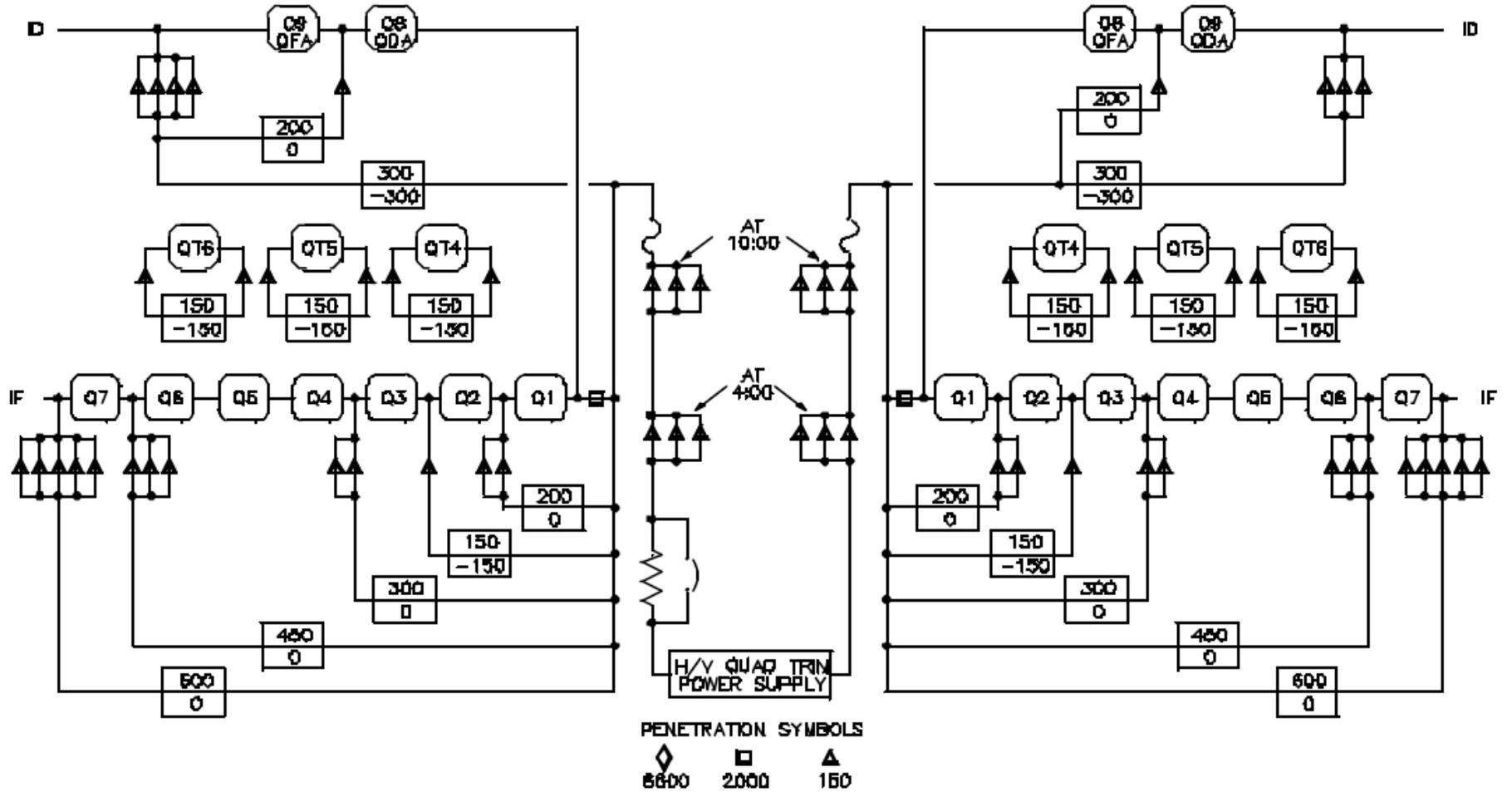
IR2,6,8 and 12



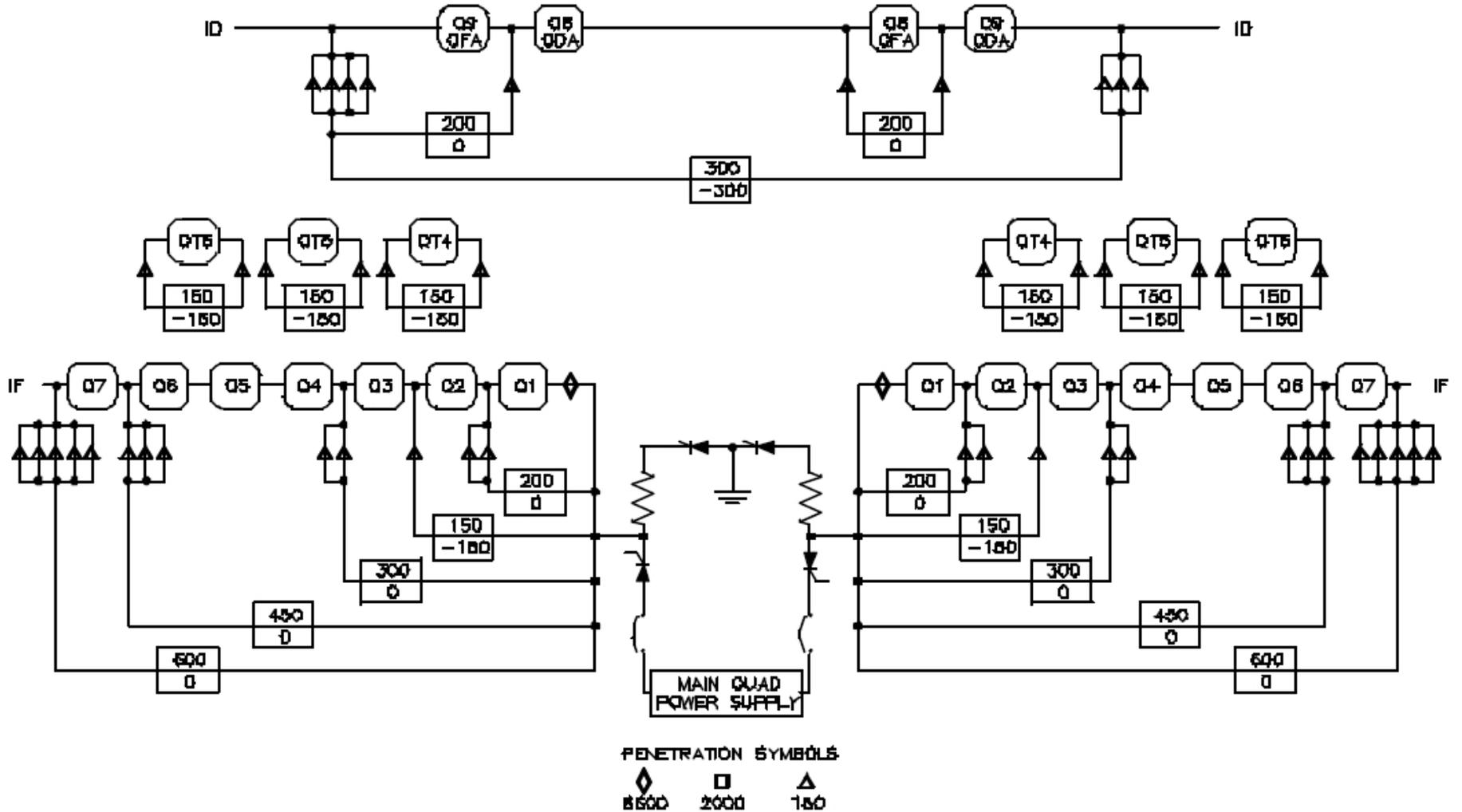
PENETRATION SYMBOLS

◇ 600 □ 200 ▲ 150

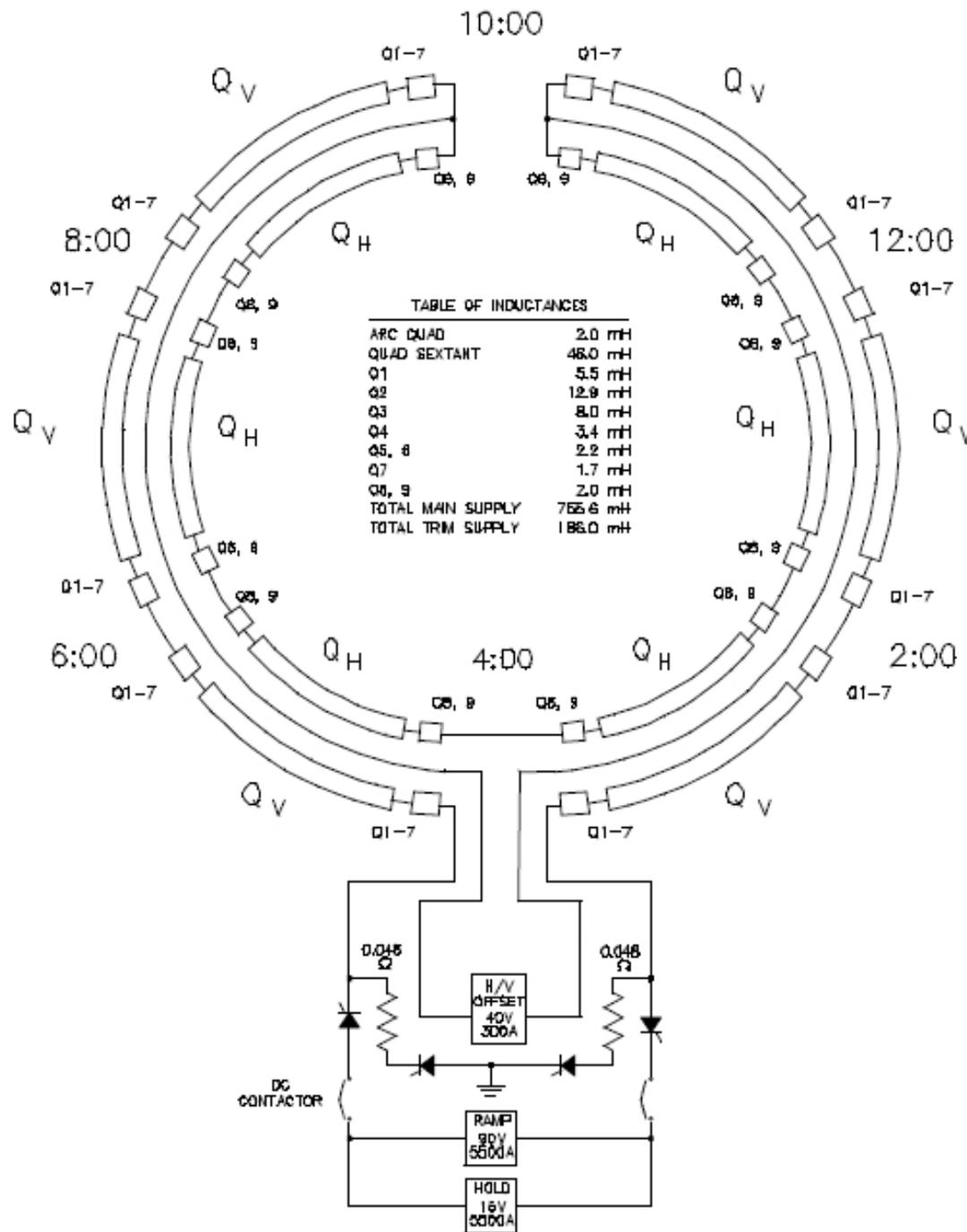
IR10



IR4



OpticsC



Global Optics Correction

OpticsCorrection

- What is it?

$$\frac{\Delta\beta}{\beta} = -\frac{1}{2\sin(2\pi Q)} \sum_i^{nquad} \Delta k_i \beta_i \cos(2\pi Q + 2(\psi - \psi_i))$$

$$\left(\frac{\Delta\beta_j}{\beta_j} \right)_{nbpm} = (M)_{nbpm \times nquad} (\Delta k_i)_{nquad}$$

Phase advance

$$(\Delta k_i)_{nquad} = (M)^{-1}_{nbpm \times nquad} \left(\frac{\Delta\beta_j}{\beta_j} \right)_{nbpm}$$

- Calculate gradient deviation from the model
- Only work for small perturbation and assume the model is pretty close to reality
- Demonstrated proof-of-principle in RUN2009 ago with a dialed-in gradient error of one of the IR trim quads
- Briefly tested correction at injection with only IR trim quads. No conclusions due to limited data